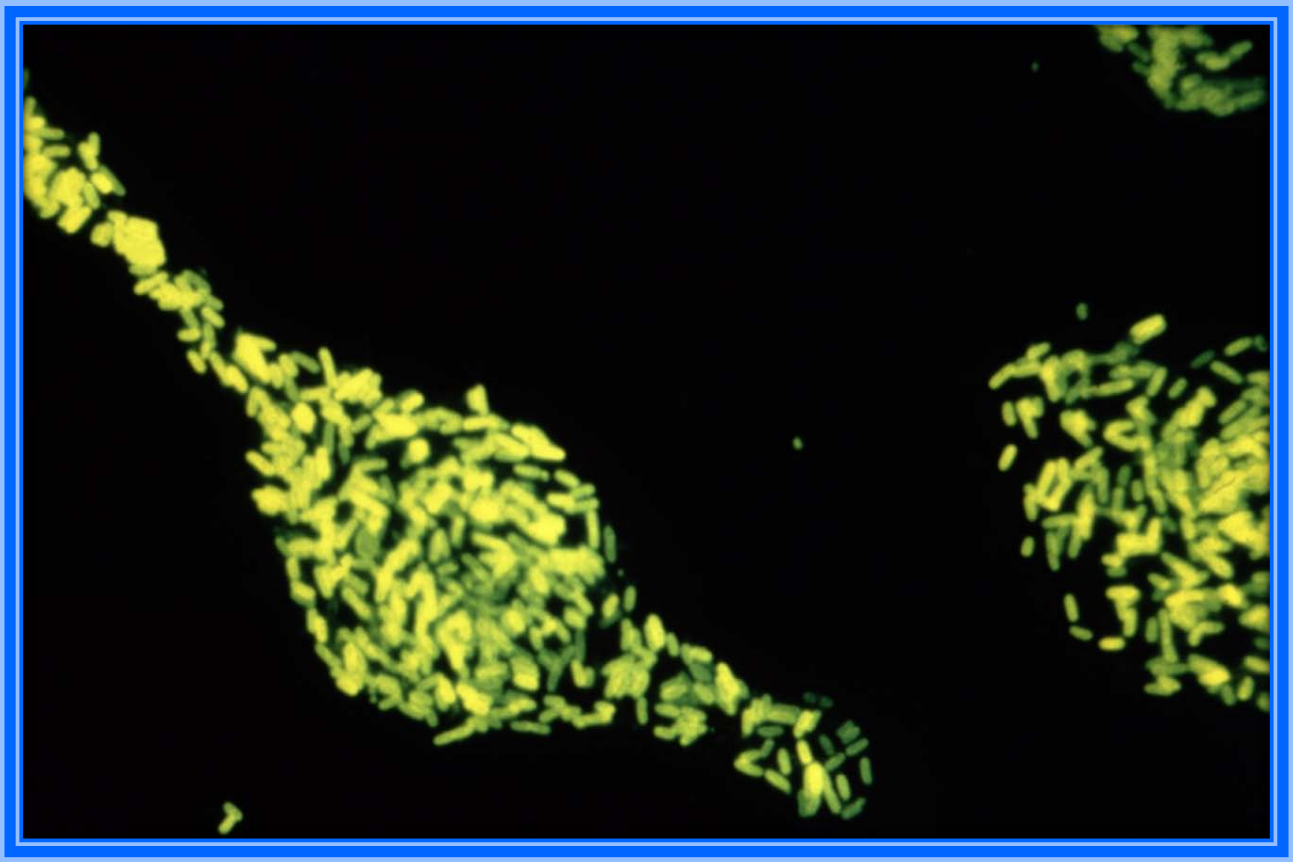
Chapter 8:

Microbial Threats



Salmonella

Source: CDC Public Health Image

Foodborne Illness

According to the Centers for Disease Control and Prevention (CDC), every year approximately 1 out of 6 Americans get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases. Over 90% of domestically acquired foodborne illnesses are caused by one of five pathogens, norovirus (58%) *Salmonella spp.* (11%), *Clostridium perfringens* (10%), *Campylobacter spp.* (9%), and *Staphlococcus aureus* (3%). Although salmonella is not the leading cause of foodborne illness, it is the leading cause of hospitalizations (35%) and death (28%) for foodborne illnesses.[1]

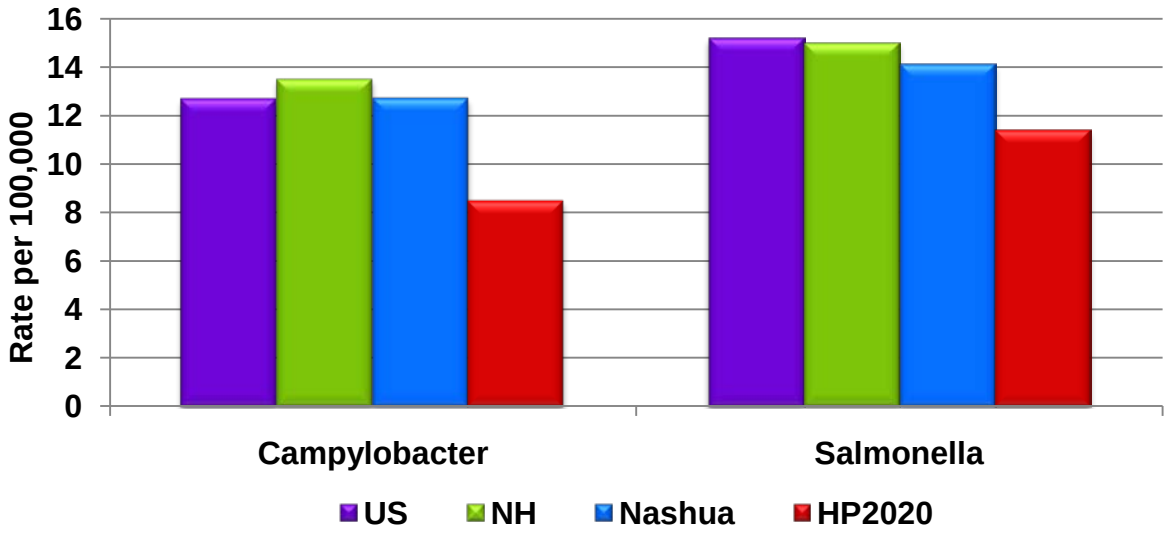
Reducing foodborne illness by just 10% would keep about 5 million Americans from getting sick each year. Preventing a single fatal case of *Escherichia coli* O157 infection would save an estimated $7 million.[1] The Healthy People 2020 overall objective is to improve food safety and reduce foodborne illness.[2] One way in which this is to be achieved is by reducing infections caused by key pathogens transmitted commonly through food.[2]

The two most common reportable foodborne illnesses in New Hampshire are campylobacter and salmonella.[3] Nationally, there were approximately 15.2 cases of salmonella per 100,000 population per year and 12.7 cases of campylobacter per 100,000 population per year from 2006 to 2008.[2] From 2005 to 2010, New Hampshire had similar rates of salmonella (15 cases per 100,000 per year) and campylobacter (13.5 cases per 100,000 per year).[3] Nashua rates from 2005 to 2010 were also comparable to national rates with 12.7 cases per 100,000 per year of campylobacter and 14.1 cases per 100,000 per year of salmonella (Figure 8.1).[4] Healthy People 2020 seeks to decrease campylobacter infections from 12.7 cases per 100,000 population per year to 8.5 cases per 100,000 (a 33% improvement), and salmonella infections from 15.2 cases per 100,000 population per year to 11.4 cases per 100,000 (a 25% improvement).[2] In Nashua, there were 55 cases of campylobacteriosis, 12 cases of *Escherichia coli O157* infections or other shiga-toxin producing *E. coli,* 61 cases of salmonellosis and four other confirmed foodborne illness cases from 2006-2010 (Table 8.1).[4]

"Every year approximately 1 out of 6 Americans get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases."

- CDC

Figure 8.1 Rates of Confirmed Salmonella and Campylobacter Cases, 2006-2010



Source: NH DHHS, NHEDSS

Table 8.1 Foodborne Illnesses in Nashua, 2006-2010

	Total
Campylobacteriosis	55
Escherichia coli 0157* or other shiga-toxin producing *E. coli	12
Salmonellosis	61
Other	4
Source: Nashua DPHCS; NH DHHS	

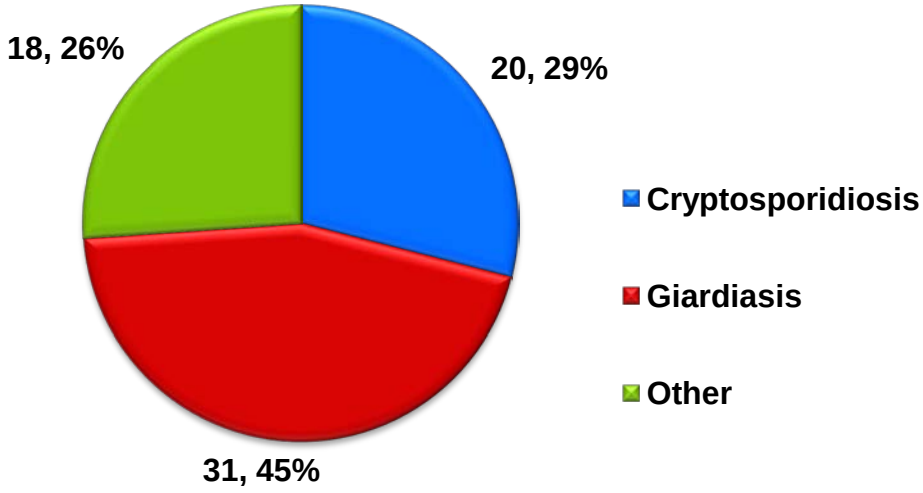
Waterborne Illness

Waterborne diseases are caused by organisms that are directly spread through water and water-related illnesses can be acquired due to a lack of water for hygiene and a lack of sanitation.[5]

Water-related diseases can be caused by bacteria (e.g. species of *Legionella*, *Pseudomonas*, *Shigella, Vibrio*), parasites (e.g. *Cryptosporidium, Giardia*), viruses (e.g. hepatitis A, norovirus, rotovirus) and the presence of chemicals (e.g. arsenic, copper, lead).[6] The top five causes of illness outbreaks in drinking water are *Giardia intestinalis*, *Shigella*, norovirus, hepatitis A, and the presence of copper. The top five causes of recreational water illness outbreaks are *Pseudomonas*, *Cryptosporidium*, *Shigella*, *Legionella*, and norovirus/calcivirus.[7]

In New Hampshire, the most common reportable cause of waterborne illness is giardiasis, with an average of 114 cases per year from 2006-2010, followed by cryptosporidosis (59.4 cases per year), legionellosis (18 cases per year), shigellosis (11.6 cases per year) and vibriosis (2.6 cases per year).[3] In Nashua, from 2006-2010, giardiasis was the leading reportable cause of waterborne illness with 6.2 cases per year and accounting for 45% of waterborne illnesses from 2006-2010, followed by cryptosporidiosis with 4 cases per year and accounting for 29% of cases from 2006-2010. There are approximately 2.4 cases per year of shigellosis in Nashua (Figure 8.2, Table 8.2).[4]

Figure 8.2 Waterborne Illnesses by Percent in Nashua, 2006-2010



Source: Nashua Division of Public Health and Community Services

Table 8.2 Waterborne Illnesses in Nashua, 2006-2010

	Total
Cryptosporidiosis	20
Giardiasis	31
Shigellosis	12
Other	6

Source: Nashua DPHCS; NH DHHS

For more information on foodborne and waterborne diseases, visit the Centers for Disease Control and Prevention website at http://www.cdc.gov/ncezid/dfwed/.

Vaccine Preventable Diseases

Although vaccine-preventable disease levels are near record lows, only 68% of infants and toddlers have received all recommended vaccines by age three. Many children, adolescents and adults remain under-immunized, leading to the potential for outbreaks of disease including pertussis, varicella and measles.[8, 10] Under-immunization also results in missed opportunities for people to protect themselves against diseases such as hepatitis B, influenza, and pneumococcal disease.[8]

Vaccines are among the most cost-effective clinical preventive services and childhood immunization programs provide a high return on investment. According to Healthy People 2020, each birth cohort vaccinated with the routine immunization schedule (DTap, Td, Hib, Polio, MMR, Hep B, and varicella vaccines) saves 33,000 lives, prevents 14 million cases of disease, reduces direct health care costs by $9.9 billion, and saves $33.4 billion in indirect costs.[9]

Unvaccinated and under-vaccinated people place their community at risk for outbreaks of vaccine-preventable diseases.[9] For example, according to the CDC, there were more measles cases reported in 2008 than in any other year since 1997 and more than 90% of those people infected had either not been vaccinated or their vaccination status was unknown.[12] Although measles was declared eliminated in the US in 2000, approximately 200,000 people around the world continue to die each year from measles and measles complications.[12, 23] As long as measles remains endemic in the rest of the world, there will continue to be cases that appear in the US. In the first 19 weeks of 2011, 118 cases of measles were reported in the US and 105 (89%) of those have been associated with travel from other countries.[24]

"Unvaccinated and under-vaccinated people place their community at risk for outbreaks of vaccine-preventable diseases."

- **Healthy People 2020**

Healthy People 2020 seeks to reduce, eliminate, or maintain elimination of cases of vaccine-preventable diseases including *Haemophilus influenza* type b, hepatitis B, measles, mumps, pertussis, polio, rubella and varicella. In addition, Healthy People 2020 challenges us to reduce group B streptococcal infections in infants, meningococcal disease and invasive pneumococcal infections.[10]

In 2008, 115 confirmed cases of measles, 421 confirmed and probable cases of mumps, 10 confirmed cases of rubella, and 582,535 reported cases of varicella (children aged 17 years or younger) were reported in the United States.[10] Before the introduction of Tdap (Tetanus, Diphtheria, Pertussis vaccine) in 2005, there was an average of 3,995 confirmed and probable cases of pertussis per year among adolescents 11 to 18 years of age from 2000-2004 in the United States.[10,11] There was also an average of 2,777 cases per year of pertussis in children under 1 year of age from 2004-2008 in the United States.[10]

In New Hampshire from 2006-2010, there was one confirmed case of measles, 14 confirmed cases of mumps, and no cases of rubella. There was also an average of 288 cases per year of varicella and 91 cases per year of pertussis (all ages).[3] In Nashua, there was a total of 22

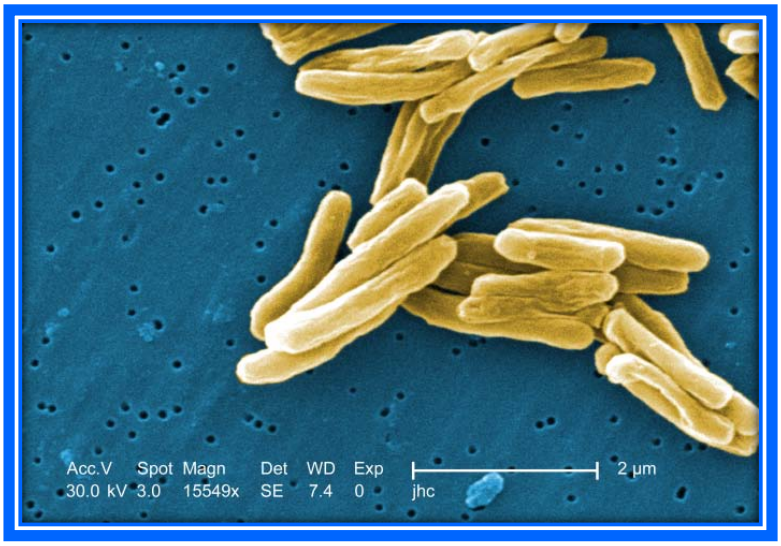
probable and confirmed cases of pertussis in Nashua with an average of 4.4 cases per year from 2006-2010. In Nashua, there were also 150 probable and confirmed cases of varicella reported from 2006-2010 (average 30 cases per year) with 143 of those cases occurring in children aged 17 years of age or younger.[4]

Healthy People 2020 seeks to reduce the number of measles cases in the US from 115 cases (reported in 2008) to 30 cases per year. Other Healthy People 2020 goals include targets of no more than 2,500 cases per year of pertussis in children under one year, 2,000 cases of pertussis in children aged 11 to 18 years of age, and 100,000 cases per year or less of varicella among persons aged 17 years or younger. Current incidence of mumps and rubella in the United States have met the Healthy People 2020 goals of 500 cases per year or less of mumps and 10 cases per year or less of rubella.[10]

Tuberculosis

Tuberculosis (TB) is a disease caused by a bacterium called *Mycobacterium tuberculosis*. Although this bacteria usually attacks the lungs, it can affect any part of the body including the kidney, spine, and brain. If not treated properly, TB disease can be fatal.[15] TB disease was once among the leading causes of death in the United States, accounting for 194.4 deaths per 100,000 population in 1900.[14,16] As recently as 1953, over 84,000 people in the US had active TB and more than 19,000 of them died (12.4 people per 100,000 population).[3] Although these numbers have improved, in 2007 there were still over 13,000 cases of active TB disease in the US with 554 deaths.[15]

The Healthy People 2020 objective is to reduce the rate of active TB cases reported to the CDC from 4.9 cases per 100,000 population to 1.0 case per 100,000.[13] In New Hampshire, the current case rate is just over the Healthy People 2020 goal at 1.1 cases of active TB per 100,000 population, although the Nashua case rate is slightly higher at 1.4 cases per 100,000.[4,16]



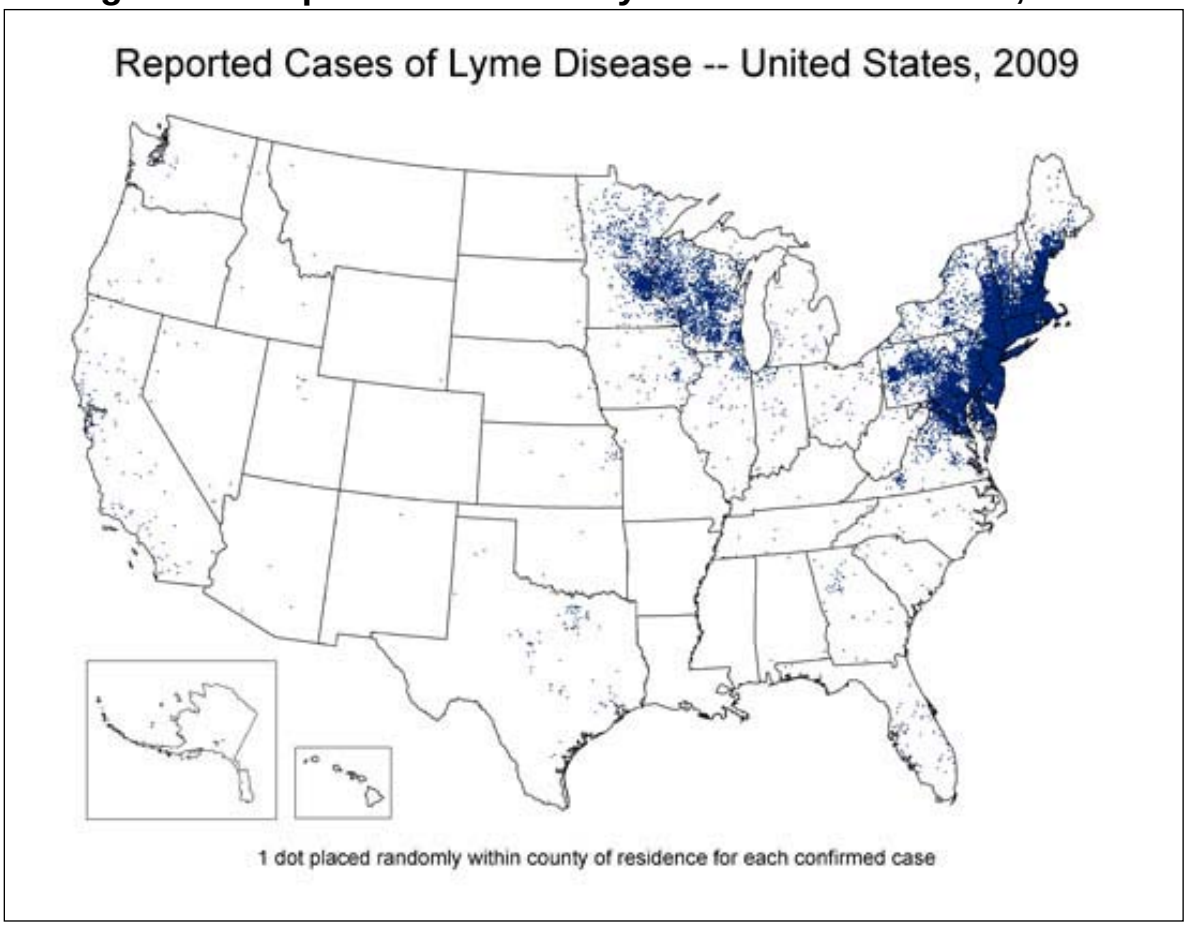
Scanning electron micrograph of gram-positive *Mycobacterium tuberculosis*
Source: CDC Public Health Image Library, Ray Butler

Lyme Disease

Lyme disease is caused by a bacterium called *Borrelia burgdorferi,* which is transmitted to humans by the bite of an infected blacklegged tick.[17] Initial symptoms of lyme disease include fever, chills, fatigue, headache, muscle and joint pain, and a characteristic "bull's eye" skin rash called erythema migrans.[17, 20] If left untreated, infection can spread to the joints, the heart and the nervous system. Lyme Disease can cause long term pain and swelling in the joints, arthritis, and neurological problems including shooting pain, numbness and tingling in the hands and feet, and changes in short-term memory.[17, 20] Lyme disease is typically diagnosed based on signs and symptoms and a history of possible exposure to infected blacklegged ticks. Laboratory blood tests are available and Lyme disease can often be treated successfully with a few weeks of antibiotics if started in the early stages of infection.[17] Ten to twenty percent of people with Lyme disease have post-treatment Lyme disease syndrome, and continue to have persistent or recurrent symptoms, even after receiving appropriate antibiotic treatment.[21]

In 2009, the incidence of Lyme disease in the US was 13.4 confirmed cases per 100,000 population.[18] The distribution of Lyme disease in 2009, however, was highly concentrated in the northeast with the incidence of Lyme disease as high as 111.2 per 100,000 population in Delaware, 78.2 per 100,000 population in Connecticut, and 75.2 cases per 100,000 in New Hampshire (Figure 8.3).[18, 19]

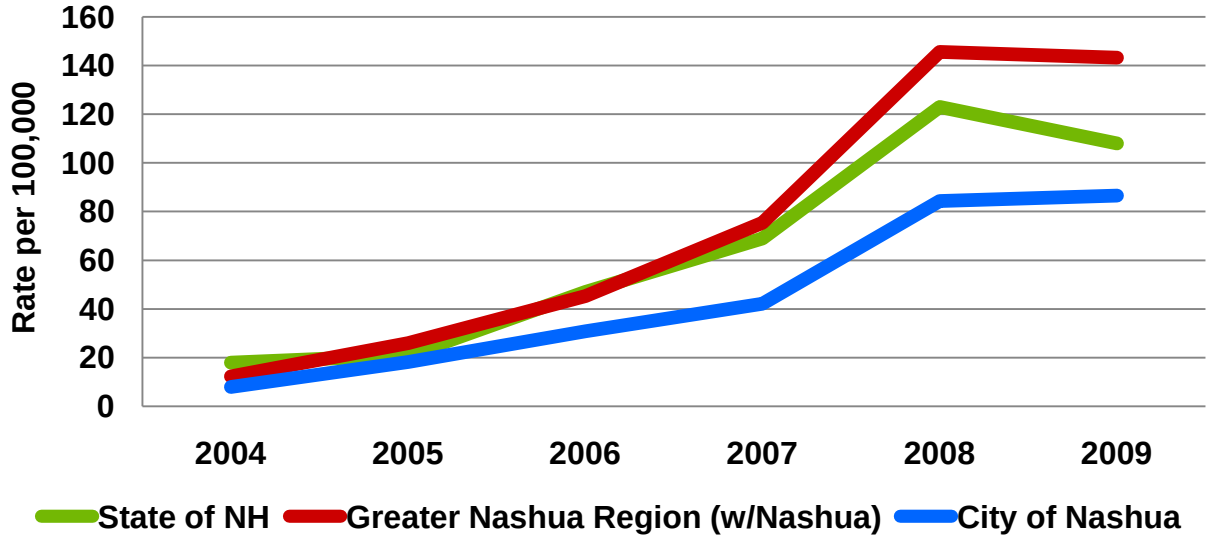
Figure 8.3 Reported Cases of Lyme Disease in the US, 2009



Source: CDC

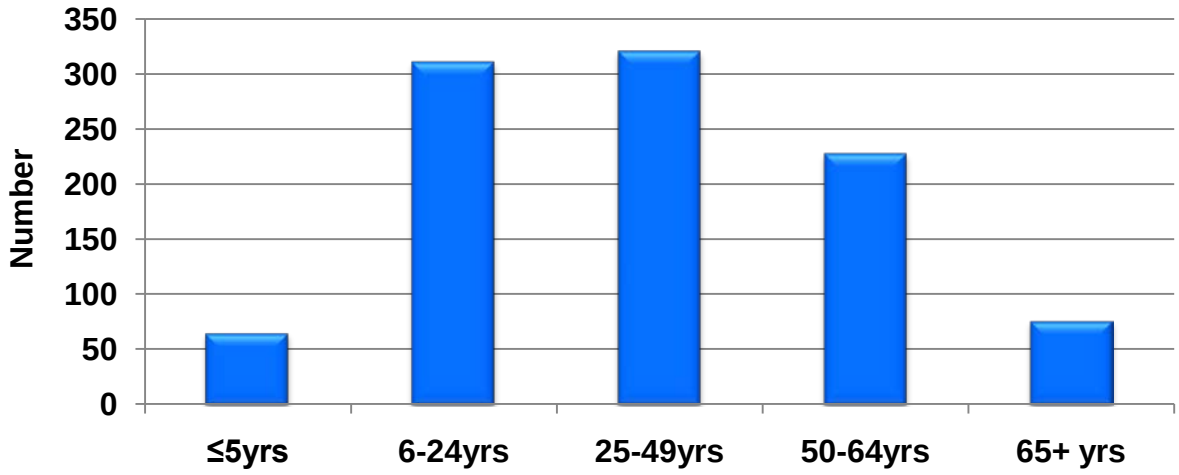
In 2010, there were 1,342 cases of Lyme disease in NH and 425 cases in Hillsborough County. Strafford County had the highest rate of Lyme disease in 2010 at 168.7 and Hillsborough came in third with a rate of 106.1. Over 60% of the ticks that were sampled and tested were infected with *Borrelia burgdorferi*. [22] The incidence of Lyme in the Greater Nashua Region in 2009 was 143 per 100,000 and in Nashua it was 87 per 100,000 (Figure 8.4). In 2009, 21.4% of the Lyme cases in NH came from the Greater Nashua Region. The age groups that are predominately affected by Lyme disease in the Greater Nashua Region are 6 to 24 and 25 to 49 year olds.[4]

Figure 8.4 Incidence of Lyme Disease, 2004-2009



Source: NH DHHS; Nashua DPHCS

Figure 8.5 Reported Lyme Disease Case Count for the Greater Nashua Region by Age, 2002-2009



Source: NH DHHS, Nashua DPHCS

[1]US Centers for Disease Control and Prevention. (2011). *CDC Estimates of Foodborne Illness in the United States*. Atlanta, GA. Retrieved from http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html.

[2]Healthy People 2020. (2010). *Healthy People 2020 Summary of Objectives: Food Safety*. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/pdfs/FoodSafety.pdf.

[3]NH DHHS. (2011). *Reportable Communicable Diseases in New Hampshire, 2006-2011 YTD*. Retrieved on June 9, 2011 from http://www.dhhs.nh.gov/dphs/cdcs/documents/monthly.pdf.

[4]City of Nashua, Division of Public Health & Community Services. *Community Health Department Reportable Diseases Database*. Nashua, New Hampshire: City of Nashua, 2006-2010.

[5]US Centers for Disease Control and Prevention. (2010). *Water related diseases, contaminants, and injuries.* Retrieved from http://www.cdc.gov/healthywater/disease/index.html.

[6]US Centers for Disease Control and Prevention. (2011). *Water-related diseases, contaminants and injuries by type*. Retrieved from http://www.cdc.gov/healthywater/disease/type.html.

[7]US Centers for Disease Control and Prevention. (2010). *Water related data and statistics*. Retrieved from http://www.cdc.gov/healthywater/statistics/index.html.

[8]US Centers for Disease Control and Prevention. (2010).*Vaccines and Preventable Diseases.* Retrieved from http://www.cdc.gov/vaccines/vpd-vac/default.htm.

[9]Healthy People 2020. (2010). *Healthy People 2020 Overview: Immunization and Infectious Diseases*. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=23.

[10]Healthy People 2020. (2010). *Healthy People 2020 Objectives: Immunization and Infectious Diseases*. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=23.

[11]US Department of Health & Human Services. Health Indicators Warehouse. *Pertussis among adolescents.* Retrieved from http://www.healthindicators.gov/Indicators/Pertussisamongadolescents_984/Profile/Data.

[12]US Centers for Disease Control and Prevention. (2011). *Measles (Rubeola): Measles Outbreaks*. Retrieved from http://www.cdc.gov/measles/outbreaks.html.

[13]Healthy People 2020. (2010). *Healthy People 2020 Objectives: Immunization and Infectious Diseases*. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=23.

[14]US Centers for Disease Control and Prevention. (2011). *Tuberculosis (TB).* Retrieved from http://www.cdc.gov/tb/default.htm.

[15]US Centers for Disease Control and Prevention. (2010). *Tuberculosis (TB): Reported Tuberculosis in the United States, 2009.* Retrieved from http://www.cdc.gov/tb/statistics/reports/2009/table1.htm.

[16] U.S. Centers for Disease Control & Prevention. (2008). *Vital Statistics in the United States, 1900-1940*. Retrieved from http://www.cdc.gov/nchs/products/vsus.htm.

[17]US Centers for Disease Control and Prevention (2011). *Lyme Disease.* Retrieved from http://www.cdc.gov/lyme/.

[18]US Centers for Disease Control and Prevention (2011). *Lyme Disease: Reported Lyme Disease cases by state, 1999-2009.* Retrieved from http://www.cdc.gov/lyme/stats/chartstables/reportedcases_statelocality.html.

[19]US Centers for Disease Control and Prevention (2010). *Lyme Disease: Reported Lyme Disease Incidence Rates by state, 2005-2009.* Retrieved from http://www.cdc.gov/lyme/stats/chartstables/incidencebystate.html.

[20]US Centers for Disease Control and Prevention (2011). *Lyme Disease: Signs and symptoms of Lyme Disease.* Retrieved from http://www.cdc.gov/lyme/signs_symptoms/.

[21]US Centers for Disease Control and Prevention (2011). *Lyme Disease: Treatment.* Retrieved from http://www.cdc.gov/lyme/diagnosistreatment/Treatment/.

[22] NH DHHS. (2011). Reported Cases of Lyme disease in New Hampshire, 2006-2010. Retrieved on June 9, 2011, from http://www.dhhs.nh.gov/dphs/cdcs/lyme/documents/county2010.pdf.

[23]US Centers for Disease Control and Prevention. (2011). *Measles (Rubeola): Overview of Measles Disease.* Retrieved from http://www.cdc.gov/measles/about/overview.html.

[24]US Centers for Disease Control and Prevention. (2011). Measles – United States, January –May 20, 2011. *MMWR, 60*(20), 666-668. Retrieved from http://www.cdc.gov/mmwr/pdf/wk/mm6020.pdf?source=govdelivery.

The adult female blacklegged tick, *Ixodes pacificus*, which is known to transmit Lyme disease.
Source: CDC Public Health Library, Amanda Lottis, William Nicholson, Will Reeves, Chris Paddock